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SEPTIC ARTHRITIS
THE BRADSHAW LECTURE
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HOWARD MARSH



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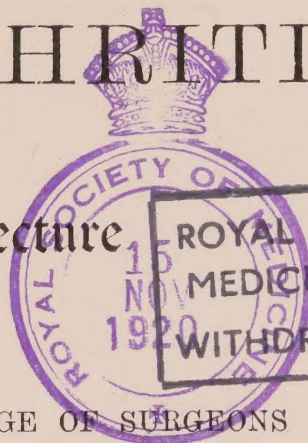
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SEPTIC ARTHRITIS

The Bradshaw Lecture



DELIVERED AT THE ROYAL COLLEGE OF SURGEONS
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BY

HOWARD MARSH, F.R.C.S.

SURGEON AND LATE LECTURER ON SURGERY AT ST. BARTHOLOMEW'S HOSPITAL
CONSULTING SURGEON TO THE HOSPITAL FOR SICK CHILDREN
PRESIDENT OF THE CLINICAL SOCIETY OF LONDON AND OF THE
METROPOLITAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION
CORRESPONDING MEMBER OF THE ORTHOPEDIC SOCIETY OF NEW YORK

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THE
BRADSHAW LECTURE

MR. PRESIDENT, LADIES AND GENTLEMEN,

My first words must convey to you, Mr. President, my thanks for conferring upon me the honour of giving the Bradshaw Lecture this year. Within the walls of the Royal College of Surgeons of England, where Hunter laid the foundation and considerably advanced the development of the grandest museum of its kind in the world, where his spirit has ever since been present to inspire his followers, and where his work has been continued, among many others, by Cooper, Lawrence, Owen, Paget, and our present distinguished curator, Professor Stewart, where our library grows year by year larger and more useful for study and reference, and where at our examinations we have in the name of English surgery highly important duties to discharge, to be invited to lecture is an honour which he who is worthy of it cannot but warmly

appreciate. Nor, certainly, can he for a moment forget the responsibilities which the office involves.

Before I pass to the Lecture itself there is a circumstance to which, Mr. President, I think you would wish me to allude.

On December 9, 1852, just fifty years ago yesterday, a certain candidate passed his examination and became a Fellow of the College. He hailed from Essex, and his name was Joseph Lister.

What that name has since become, not only in the annals of English surgery, but among the greatest benefactors of the human race, we all remember with admiration and gratitude. The poet alludes in trenchant phrase to those who shut the gates of mercy on mankind. Lord Lister has done more than any living man to throw them open. No matter in what century the roll of fame is called, the name of Lister can never henceforth be omitted from it.

Lord Lister was never the man to seek for recognition or reward, but honours have flowed in upon him from every direction; and surely his cup became full when, a few months ago, he saw his principles turned to account in one of the most dramatic incidents of history, and when, by appealing to them, Sir Frederick Treves, with conspicuous skill and conspicuous fortitude, averted

the imminent peril which beset his Majesty the King. The profound joy with which his subjects in every part of the world hailed the King's recovery was, in our profession, intensified by the fact that his Majesty, by strenuous devotion and constant personal effort in the development of his Hospital Fund—which reached the unprecedented sum this year of £100,000—has made himself the greatest and most productive philanthropist of his generation.

This Lecture, together with a similar one at the Royal College of Physicians, was founded by the late Mrs. Bradshaw to honour and perpetuate the memory of her husband, the late Dr. William Wood Bradshaw, M.A., D.C.L., Oxford. Her action was at once affectionate and enlightened. She hoped that successive lecturers would, each in his turn, do something to advance the profession to the pursuit of which her husband had devoted his life. And it remains to each Bradshaw lecturer to give effect, to the best of his capacity and knowledge, to the objects which she had in view.

The subject I have chosen is that of Infective Arthritis; in other words, I propose to discuss those diseases of the joints which are due to infection. I have not taken this subject as one that is altogether new, for it has long been known that, in such instances as septicæmia, pyæmia, and

other allied conditions, the joints are liable to become infected. I have chosen it because recent advances in bacteriology and exact clinical observation have made it clear that joint-affections of this origin are much more frequent than was formerly supposed. Thus, while no doubt much will still be added to our knowledge, the time, I think, has come when it may be useful briefly to review what has thus far been done.

In general pathology one of the main advances recently made has consisted in the discovery of the large part which infection by various micro-organisms plays in the production of disease. Thus, for example, peritonitis only a few years ago was supposed to arise as an independent form of inflammation—to be, as the phrase was, idiopathic. It is now well established that no such form is ever met with, but that inflammation is, in a very large proportion of cases, infective and due to micro-organisms of which several forms have been recognised. And as it is with the peritoneum, so it is with the joints. When inflammation occurs in a joint, while it is never idiopathic, it is often infective, and is produced, moreover, by agencies which, when they were first discovered, were supposed to be limited in their action to other structures. Indeed, there exists a close parallel between the peritoneum and the joints in regard to infec-

tion; and that this should be the case appears, even at first sight, probable when the similarity of structure between the peritoneum and the synovial membranes is borne in mind. Both consist of an epithelial layer and a substratum rich in blood-vessels, along which infective agents easily pass, and through the walls of which their migration can readily take place. A notable illustration of joint-infection is met with in the case of the pneumococcus, or the *Bacillus lanceolatus*. This micro-organism, originally discovered in the saliva, and shown to be a pathogenic agent by Sternberg, was subsequently proved by Fränkel to be the active agent in the production of acute lobar pneumonia, and, in the absence of any suspicion that it invaded other organs, it was termed the pneumococcus, or lung coccus. Later investigations have shown, however, that it has a far wider range, and that it not only produces pleurisy, pericarditis, peritonitis, and meningitis, but also acute primary arthritis.

In fact, the general statement may now be made that, in at all events the great majority of specific diseases, the joints are liable to infection. In compiling the list of these diseases, tuberculosis and syphilis need not now be considered, and the common forms of septicæmia and gonococcal infection are so well known that they need not be further alluded to. There will then remain the following:

pneumococcal infection, typhoid fever, influenza, scarlet fever, dysentery, erysipelas, and glanders. Lastly, there is the doubtful case of acute rheumatism.

PNEUMOCOCCAL ARTHRITIS.

The discovery in 1888, by Weichselbaum, that the pneumococcus has the power of producing acute inflammation of the joints, was of the highest importance, not only on its own account, but because of the impetus it gave to the study of the general subject of infective arthritis. In January 1901,¹ Dr. E. Cave published his paper on Pneumococcal Arthritis and furnished a table of the cases which had so far been recorded. The list included thirty-one examples. Dr. Cave's paper was so complete that little of importance has since been added to his description of this affection.

In all these cases arthritis was developed from two to fifteen days after the onset of acute pneumonia. In two instances, however, referred to by Cave, arthritis is said to have preceded the pneumonia, in one by three, and in the other by seven days. In three cases arthritis occurred independently of pneumonia. Of the thirty-one cases, no less than twenty-five are known to have been males. The disease in different cases attacked all the large

¹ *Lancet*, January 12, 1901, p. 82.

joints in turn—the hip, however, only in one instance. The age varied from five to seventy-one years. But only two patients were children: the great majority were between thirty and sixty, while six were over sixty, and two between seventy and eighty. In some cases only one joint was attacked, in others several were involved. The disease was somewhat more frequent in the upper than in the lower extremity.

As to the form of inflammation, suppuration occurred in as many as twenty-seven instances. The extremely grave nature of this form of arthritis is conclusively indicated by the fact that of the thirty-one cases in Cave's table no less than twenty-three—*i.e.*, nearly 75 per cent.—terminated fatally.

The high mortality which attended these cases has been observed in other cases also. It is due to the fact that the pneumococcus produces a general systemic infection—in other words, an acute and profound septicæmia, of which the arthritis is merely a local manifestation, others being, in addition to acute pneumonia, malignant endocarditis, pericarditis, pleurisy and empyema, meningitis, peritonitis, nephritis, and otitis media. In a case (Leroux's) mentioned by Cave the necropsy disclosed endocarditis, pleurisy, a purulent meningitis, peritonitis, and arthritis—a group of lesions which

shows that, amongst agents giving rise to general infection, the pneumococcus occupies a bad pre-eminence, while its morbid anatomy may be summarized in the statement by Cave that it is essentially the same as that of any other septic infection.

The pathology of the pneumococcus in respect to the human subject and to animals has been set forth by Foulerton in an able and exhaustive paper printed in the 'Lancet,' August 1901, p. 472.

TYPHOID ARTHRITIS.

Since attention was first drawn to the subject by Parise in 1842, several writers have alluded to it and recorded their observations. Among these may be especially mentioned Keen of Philadelphia,¹ who in 1898 published his important monograph on the complications and sequelæ of typhoid fever, including a chapter on affections of the joints; and Barjon and Lesieur,² whose essay was published in 1901.

Keen, placing himself in line with previous writers, states that there are three forms of joint-

¹ Keen, *Surg. Complications and Sequels of Typhoid Fever*, 1898.

² 'Septicémie Eberthienne à forme d'Arthrotrophus sans lésions intestinales ni spléniques, avec réaction de Widal positive,' par MM. F. Barjon et Ch. Lesieur, *Journal de Physiol. et de Pathol. Générale*, 15 Mars, 1901, p. 250.

disease met with in association with typhoid fever—

1. Rheumatic typhoid arthritis.
2. Typhoid arthritis proper.
3. A form of septic arthritis.

Rheumatic Typhoid Arthritis.—Under this head it has been customary to place cases in which at the commencement of the illness—sometimes as the earliest symptom—the patient complains of severe pain in the knees, elbows, or other joints, which are the seat of varying degrees of swelling. Usually the affection lasts for a few days, and then disappears without leaving any ill effects. In other instances effusion increases in quantity and suppuration occurs. As a good example of this early form Dr. Percy Kidd has given me notes of the following case :

A girl, aged seventeen, was admitted into the London Hospital, December 9, 1899, having complained for two or three days of pain in her left knee, which was swollen. Her case was at first regarded as one of acute rheumatic arthritis. The knee, however, became worse, and on the 14th was explored, as suppuration was suspected. No pus was found. Two days later the temperature was 105°, and diarrhoea, faint rose spots, and Widal's reaction disclosed typhoid fever. Death occurred sixteen days later from intestinal hæmorrhage, and

typhoid ulcers were found in the intestines. The joint-affection had subsided. Unfortunately, no bacteriological examination was made.

To speak of these cases—not that Dr. Kidd does so—as ‘rheumatic’ typhoid arthritis is but another example of the confusion that results when such a term as rheumatism, which at present admits of no exact definition, is so used as to suggest pathological theories. The real nature of this form of arthritis is at present undetermined. But it seems likely that it will prove, on further investigation, to be the direct result of the irritative action of the typhoid bacillus.

Septic Arthritis complicating Typhoid Fever.—It will readily be understood, when the condition of exhaustion to which the patient is reduced by typhoid fever is borne in mind, that septic arthritis is a highly dangerous complication. It is, in fact, very generally fatal. It, however, presents no specific characters. It is, as Keen remarks, an instance of the common form of septic infection, and is due to the presence of streptococci or staphylococci which have been absorbed from boils, or bed-sores, or from the surface of intestinal ulcers. Perhaps the *Bacillus coli communis* may also in some instances be concerned; but as to this there is, so far as I know, no positive information.

Then there is the condition which is termed

Typhoid Arthritis proper. This is met with either in the acute stage of typhoid fever or towards its decline. Occasionally it makes its appearance during convalescence. Its features vary in different cases. Several joints may be involved (polyarticular form) or it may be limited to one (monarticular). In the former, two, three, or more of the large joints may be attacked. There is pain, together with more or less swelling, due in part to infiltration and thickening of the synovial membrane, and in part to the effusion of turbid fluid into the joint-cavity. In some instances the attack subsides and recovery follows ; in others the joints, after prolonged inflammation, undergo fibrous ankylosis, which can be removed, if at all, only by repeated manipulation under an anæsthetic and prolonged passive movement and massage. Or, again, suppuration may ensue, necessitating free incision and irrigation.

In the monarticular variety it is the hip which in the great majority of cases is involved, and the result is usually serious, for some cases end in firm fibrous ankylosis much resembling that which ensues after gonococcal infection, while in others (and more frequently) the capsule becomes distended by serous effusion, and then, either spontaneously or when the patient is lifted, dorsal dislocation is apt to occur.

The pathology of this group of cases is as yet but imperfectly worked out. Such evidence, however, as I have said, as is at present available tends to indicate that the arthritis is due to the local action of the typhoid bacillus on the tissues concerned. It is well known that, although the typhoid bacillus is not usually present in the general circulation, it is to be found in the liver and spleen, bone marrow, and the rose spots on the skin—in other words, that it is widely distributed in the tissues. It is therefore easy to see that, along with other parts, the joints may be invaded by it. Positive evidence, however, of the presence of the bacillus in the joints is as yet very limited. Several observers who have examined fluid withdrawn from joints in these cases have found that it was completely sterile. Too much weight must not be attached to this negative result. Possibly the bacillus, although originally present, subsequently dies and is disintegrated. It is not rare to find collections of pus in various parts which are sterile, but which almost certainly were produced by micro-organisms now no longer to be found; and Cave remarks that, even in some cases of suppurative arthritis occurring in association with pneumonia, the pus removed from the joints has been sterile, although in such cases it is nearly certain that the pneumococcus was originally present. Or the explanation suggested

by Widal, that the arthritis is produced not by the pneumococcus itself but by toxins derived from it, may be correct. And a similar view may be held in the case of the arthritis of typhoid.

On the other hand, Delanglade and Chibret¹ found the typhoid bacillus in the joint-fluid, while Orloff produced arthritis by injecting the bacillus into the joints of a rabbit.

SCARLET FEVER.

The arthritis which is not very rarely associated with scarlet fever occurs in two forms. The first is often indistinguishable, clinically, from acute rheumatism. It makes its appearance either quite early—while the rash is still present—or during the desquamative period. It usually involves several joints, is not severe in character, and, in the majority of cases, soon subsides. As to its pathology, Dr. Hilton Fagge remarks, ‘Probably most cases of synovitis following scarlet fever are true rheumatism.’ Osler regards it as analogous to gonococcal arthritis; while Dr. F. Taylor holds practically the same view as Osler, for he says, ‘Although known as Scarlatinal Rheumatism, it is possibly an arthritis due to the direct action of the septic organism of the primary disease.’ This, in

¹ Barjon and Lesieur, *loc. cit.* p. 258.

the present state of our knowledge, judging by such instances as the pneumococcal, gonococcal, and probably also typhoid arthritis, is likely to be the correct view. The second form is much more severe, and not rarely ends in suppuration. It is usually, as Strümpell remarks, a part of secondary sepsis or a general pyæmia as evinced by such other lesions as empyema, subcutaneous abscesses, splenic tumour, &c. Here, as in the septicæmic form of typhoid arthritis, the infective agent is the *Streptococcus pyogenes* or the staphylococcus.

INFLUENZA.

I have met with two cases which appear to suggest that, with whatever rarity, arthritis may follow influenza.

On this subject Boncoumié has contributed a paper to the '*Bull. Gén. de Thérapeutique*,' vol. 140, p. 5, 1900. His observations, however, refer not to any specific form of arthritis directly dependent on influenza, but to the predisposition which influenza establishes to attacks of ordinary gout. The subject is one about which little is known, but it seems possible that these cases of Boncoumié which resembled gout may have been due directly to the action of the influenza bacillus.

The first of my cases was that of a gentleman aged forty-two, whom I saw with Dr. Hetley, of

Norwood. The patient had a sharp attack of influenza (which was at the time epidemic in his neighbourhood) on May 3, 1891. Two days later he complained of severe pain apparently in the glands below Poupart's ligament, and had a rigor, copious sweating, and a temperature, for the next ten or twelve days, ranging between 102° and $103^{\circ}5$. During this time nothing abnormal could be detected in the groin or thigh till, on May 11, a band of œdema appeared running down the outer side of the limb from the trochanter nearly to the knee, but this was neither painful nor tender. Pain was situated chiefly in Scarpa's triangle on the inner side of the femoral vessels. There was a tender spot, also, over the sciatic notch. On May 14 the temperature went down and the œdema subsided, but some thickening could be felt in front of the joint, and the artery seemed to be pushed forward. At this time the limb was becoming flexed and adducted. There was marked muscular wasting, and pain about the joint was so severe as to call for the hypodermic injection of morphia. Two consultations were held in the next three weeks, but the nature of the case remained obscure. Dr. Hetley, however, formed the opinion that the hip-joint was involved. I first saw the case on July 5. The patient was very weak; the temperature was 101° to 103° . The limb was flexed and

adducted; there were night startings and much muscular wasting. Any attempt to move the limb produced severe pain. It was obvious that the joint was actively inflamed. Weight extension in the axis of deformity was used. The symptoms gradually subsided, and the patient gained flesh and strength and was able in about two months to be up on crutches. When I saw him again in the following December there was three-quarters-of-an-inch of shortening and some adduction of the limb; the trochanter was considerably above Nélaton's line. The joint was stiff, but all active symptoms had ceased. At the present time the patient walks with a stick, but lameness is marked. He has only fatigue-pain. No further shortening has taken place. Anyone who now examined the limb would probably regard the case as one of monarticular osteo-arthritis. A few days after the hip was attacked the patient complained of pain in the knee, which was enlarged from peri-articular infiltration. There was no fluid in the synovial cavity. This condition persisted for four or five weeks, but then slowly subsided. The joint ultimately completely recovered.

In the second case, a boy aged eighteen, after a moderately severe attack of influenza, complained of severe pain about the right hip. On his admission in October 1901 into St. Bartholo-

mew's Hospital the limb was slightly flexed. The hip was stiff and there was much brawny œdema of the soft parts in Scarpa's triangle and in the iliac fossa, and below and a little internal to the iliac spine there was a suspicion of fluctuation. The inguinal glands were enlarged and the muscles were wasted. The position of the limb was corrected by weight extension. The brawny thickening persisted for several months, and suppuration often appeared imminent. At the present time the joint is stiff; there is no pain. Some thickening still remains around the joint. The patient walks with only slight lameness.

ERYSIPELAS.

Arthritis as a complication of erysipelas appears to have been first recorded by William Musgrave¹ in 1702, and Boissier de Sauvage mentioned it in 1740. But the arthritis in question was believed to be acute rheumatism, and was by some later writers termed erysipelatous pseudo-rheumatism.

An important contribution to this subject consists of a thesis written by Dr. René Jorrot, published in 1899.² Dr. Jorrot has collected from various sources a number of cases which

¹ *De Arthride Symptomática.*

² Thesis, before Fac. of Med. and Pharmacol. of Lyons, November 1899.

show that the joint-affection usually occurs in the acute stage of erysipelas, though in a few instances it comes on when the disease is declining. Like the arthritis met with in septicæmia, it may occur as—

(a) A transitory synovitis attended with serous effusion and involving many joints, and sometimes the sheaths of tendons.

(b) A plastic form tending towards fibrous ankylosis. This form may be persistent over many weeks; in one case it lasted two and a half months.

(c) An acute suppurative arthritis by which the joints are rapidly disorganised.

No exhaustive bacteriological investigation seems to have taken place as to the agent by which the arthritis is produced. In the early days a chain coccus was described by Fehleisen as the *Streptococcus erysipelatis*, but this is now very generally regarded as identical with the *Streptococcus pyogenes*. Suppurative arthritis appears to be rare as a complication of erysipelas. Jorrot calls it very rare—one in about two hundred cases.

GLANDERS.

Delafield and Prudden¹ allude to arthritis as met with in the course of glanders, but they give no detailed account of the affection; nor have I

¹ *Path. Anat. and Hystology*, 6th edit. p. 196.

found elsewhere any full description of it. It would probably be acute and destructive.

ACUTE RHEUMATISM.

As to acute rheumatism, although it is believed by many authorities from the evidence already obtained that it is an infective disease, there is up to the present no agreement as to the agent by which it is produced; some believe it to be the diplococcus first described by Triloubet, and since carefully studied, among others, by Paine and Poynton. Singer, but with few adherents, holds that it is the streptococcus or the staphylococcus; others consider that the disease is caused, not by any one micro-organism exclusively, but by a mixed infection arising from bacteria lodged in the tonsils or the adenoid tissue of the pharynx.

I have now passed in brief review the principal instances in which the joints are liable to infection in the course of the various specific diseases, and it will be apparent that the infective agent is different in different cases. In some cases it is the same micro-organism (or its toxins) as that which produces the primary disease—as, for example, when acute arthritis occurs as a complication of pneumonia and the pneumococcus is found in the joints; or when arthritis, developed in the

course, or as a sequel of typhoid fever, depends on the local action of the typhoid bacillus.

The arthritis found in association with scarlet fever appears to be a mild form of ordinary septicæmia due to the *Streptococcus pyogenes*, or the staphylococcus; while that which is sometimes met with in dysentery is the result of a mixed infection in which, perhaps, the *Bacillus coli communis* plays a chief part.

In studying these infective agents, it is to be remembered that the effects which they produce may be largely influenced by the varying conditions under which they are placed, as determined, for example, by the resisting power of the individual attacked, the dose received, and the presence of other micro-organisms or their toxins. These are matters about which at present little is known. Little, for instance, I think, is known as to the influence which the typhoid bacillus or its toxins may have in modifying the action of the streptococcus or the staphylococcus, or *vice versâ*.

The changes met with in joints which are the seat of infective arthritis vary considerably in different instances. In some they are slight and transient, and result from synovitis attended with infiltration of the subsynovial tissue, and with some, but only a limited amount, of serous effusion into the cavity of the joint. This is the case, *e.g.*,

in the arthritis which occurs in the early stage of scarlet fever and typhoid fever.

In a second group one, two, or more of the joints are painful and swollen from effusion of fluid into the synovial cavity. These are the cases which have been so misleading in consequence of the close similarity of the appearances observed, on clinical examination, to those of acute rheumatism.

Although at first, as I have said, merely turbid, the fluid in the joint in some instances soon becomes purulent.

In a third group the inflammatory process chiefly involves the periarticular tissues, and leads to considerable brawny or boggy swelling, and to reddening of the skin, which is, at the same time, so stretched and shiny as to suggest the presence, or near approach, of suppuration. This is one of the most clearly marked types of infective arthritis, and one with which we have long been familiar in some of the cases of gonococcal infection. In this form there is frequently no effusion into the cavity of the joint, and, so far as I am aware, though it seems imminent, suppuration very rarely occurs. Clinically, these cases run a very prolonged and tedious course; they may extend over several weeks, some have lasted two or three months. Many are attended with pain, not only persistent but very severe, and they show a strong tendency

to result in firm fibrous ankylosis, which apparently, in some instances, gradually passes on, by ossification of the new fibrous tissue, to complete synostosis. In these respects they furnish a close parallel to one of the forms of arthritis which is met with in the course of the septicæmia which follows acute infective periostitis or osteo-myelitis.

A fourth group includes those cases in which the arthritis is, from the first, acute and destructive. Suppuration takes place early, and goes rapidly on to complete disorganisation of the joint, and often to the wide burrowing of pus, which has escaped from the synovial cavity, along the inter-muscular spaces of the limb. This fourth variety is met with in its most marked phase in pneumococcal arthritis.

Thus far I have given such an account as time will permit of infective arthritis as it occurs in connection with various specific diseases.

But apart from this clearly defined group, and in widely varying circumstances, other examples are met with, and to these I will now direct attention.

Everyone who has many patients passing under his notice meets with cases of joint-affection attended with fever, and as to the nature of which he is uncertain, but which are traditionally regarded as acute or sub-acute rheumatism. Now, just as

charity covers a multitude of sins, so has the term rheumatism covered a broad expanse of loose pathology. Undefined itself, it has thrown its ægis over many conditions equally obscure. To-day, however, when it becomes more and more probable that acute rheumatism is itself an infective disease, it is seen that many cases which have been termed rheumatism may also belong to the infective class.

Certainly one of the most instructive contributions towards the elucidation of this obscure subject is the paper in the current volume of the Clinical Society's 'Transactions,' in which Drs. Paine and Poynton relate the results of their investigations into the pathogenesis of two cases of arthritis under the care of Mr. Page in St. Mary's Hospital. In Mr. Page's first case, a man, aged thirty-four, fell and sprained his right knee. About three weeks later, on his admission (January 11, 1901) to the hospital, the joint was greatly swollen and very painful. As swelling had not diminished, aspiration was performed on January 15. The pain, however, continued, and the swelling began immediately to return. The patient was restless and irritable, and as it were 'off his head.' On January 18, fluid was again removed, and the joint washed out with carbolic lotion (1-100) till the fluid returned perfectly clear. After this, steadily-progressing recovery took place.

In the second case, a boy of fourteen was admitted March 22, 1901, having hurt his knee shortly before Christmas. Some swelling followed, but passed off in a few days. On March 15 he knocked his knee against the wall as he lay in bed. The blow was followed immediately by swelling and considerable pain. On admission, the joint was tightly distended with effusion, and he was evidently very ill; his temperature was 100° to 101° , and he was restless, and irritable, and inclined to wander. On March 26 fluid was removed from the joint. The boy was, however, no better, but rather worse, and his temperature was higher. On April 2 the joint was again emptied, and washed through with carbolic lotion (1-100). From this time he steadily recovered, and left the hospital on May 9.

I can only briefly summarize the bacilliary and experimental investigations of Drs. Paine and Poynton, than which it would be difficult to find work more admirably done or more suggestive.

On cultivation the fluid contained numerous very minute diplococci in chains. Twenty minims were injected intravenously into a rabbit. Arthritis followed in several joints. The heart's action became very excited, and a systolic murmur developed at the apex. Two months later the rabbit was killed. Post-mortem examination showed mitral

valvulitis. The joints contained exudation like raw white of egg, and showed swelling due to chronic inflammation in the periarticular tissues. Two other rabbits were treated by intravenous injection, and again a polyarthrititis was produced. In none did suppuration occur. 'The investigation demonstrated,' the authors of the paper observe, 'that the exciting cause of the arthritis in the second of the two cases described by Mr. Page was a diplococcus, and that this diplococcus resembled, in its morphological and cultural characters, the diplococcus of rheumatic fever, rather than the *Streptococcus pyogenes*.'

On a subsequent occasion Drs. Paine and Poynton found, at a necropsy, in the exudation and synovial membrane of a knee-joint showing all the changes of osteo-arthritis, a diplococcus which in ten weeks produced an osteo-arthritis of the right knee-joint of a rabbit. This observation is of great importance, and we may hope it will not be long before we hear more from the authors respecting this subject.

The severe form of osteo-arthritis occasionally met with after parturition seems especially suitable for bacteriological investigation.

In October 1901, at the Clinical Society, Dr. Percy Kidd showed a female patient, aged twenty-six, who, eighteen months before, had become the

subject of chronic bronchiectasis. Six months later, the sputum was offensive and more copious, and the ankle-joints became affected. Subsequently, the wrists and knees were involved. When the patient was exhibited, both wrists were swollen, stiff, and tender. The fingers were generally enlarged, the joints swollen and tender, and the ends clubbed. The knees were swollen and each contained a little fluid. The ankle-joints were swollen but not tender. A remarkable point in this case was that the condition of the joints varied with the variation in the bronchiectasis, undergoing considerable improvement when the sputum was limited in amount and less foetid in character, but becoming worse when the sputum was more copious and more foetid. In other words, the amount of arthritis seemed clearly to depend on the amount of absorption that was taking place.

In a second case recorded by Dr. Kidd in a man aged thirty, who was suffering from a foul and copious discharge due to bronchiectasis, the knees, wrists, and ankles were swollen and contained fluid.

The patient stated that he had had gout on several occasions during the last six years, but the present joint-affection began three years before with pain and stiffness in the knees and ankles. He had chronic cough with expectoration for three years, and for a year the sputum had had a foul taste.

The fact that this patient had suffered from gout, so that his joints were already damaged, may be noted in reference to the case recorded by Barjon and Lesieur.¹ A girl, aged seventeen, having had typhoid fever when she was eight, and acute rheumatism when she was eleven, was attacked on October 1, 1900, with acute illness, accompanied by raised temperature, a cardiac bruit, and painful swellings of the joints. The joint-symptoms completely disappeared by October 15. But the general illness continued, and now presented the phenomena of typhoid fever: there were rose spots, profuse diarrhoea, high temperature, bronchitis, and delirium. Death occurred on October 28. On post-mortem examination no intestinal lesions were found. But that the disease had been typhoid fever was proved by the discovery in the blood (removed from the patient on October 12) of the typhoid bacillus. The view the authors held in respect to this case was that, while the glandular structures of the intestines had been rendered immune by the first attack of typhoid, and so escaped, the joints, already damaged by acute rheumatism, had lost their normal resistance, and thus became localities in which the irritative action of the typhoid bacillus or its toxins could take effect.

Thus, both in Dr. Kidd's case and in that just

¹ *Loc. cit.* p. 250.

described, the joints were, it appears, predisposed to attack in consequence of their diminished powers of resistance, produced by previous gout in one and acute rheumatism in the other. And bearing on this same loss of resistance, we notice that in Dr. Cave's table in no less than ten out of thirty-one cases, pneumococcal arthritis was developed in recently injured joints; while in a case recorded by Verco, pneumococcus infection declared itself a few hours after a young lady had been exposed to cold by passing through the house, during a night in October, in her night-dress. Within forty-eight hours the right knee-joint, which was swollen and painful, was punctured and yellow pus was withdrawn.

The influence of injury of whatever kind in predisposing joints to attack by the pneumococcus and other micro-organisms should be carefully kept in view. Unless this is done, cases really depending on infection may be regarded as merely traumatic, and so the requisite treatment by evacuation and irrigation of the affected joint may be withheld until serious mischief has taken place.

Dr. W. H. Brook recently described at the Clinical Society of London an epidemic which occurred in May 1902 in Lincoln, and which was traced to infected milk. A large number of people were suddenly attacked with a very severe sore throat and œdema of the fauces and uvula. The tonsils

were coated, in many cases, with a drab-coloured fur. The cervical glands were enlarged and tender, and there was, in many instances, a skin-rash, resembling urticaria. One patient died of pyæmia. High temperature was reduced by the administration of anti-streptococcus serum in several cases.

One of the patients, a man aged thirty-seven, on about the tenth day of illness, had intense pains in the knees, ankles, and elbows. The slightest movement produced agony. None of the joints contained fluid. There was no endocarditis. For several weeks the patient was unable to move any of his limbs. Now he can walk, but with great difficulty.

Similar joint-symptoms were present in several other instances.

On the subject of infective arthritis, Mr. Clement Lucas's observations in 1885 on the occurrence of infection of the joints as a complication of ophthalmia neonatorum, formed a very important contribution. His views are fully recorded in his paper in the 'Med.-Chir. Trans.,' 1899, while other observers have amply confirmed him. Among the most instructive papers is that by Dr. Hawthorne.¹

In this case speedy and complete recovery resulted when the conjunctival discharge was removed by treatment; that is, when the supply

¹ *Brit. Med. Journ.*, May 1902, p. 1529.

of infective material was stopped—a result corresponding with the variation in the degree of arthritis mentioned in Dr. Kidd's case, and dependent on the condition of the bronchiectasis, and on the amount and character of the discharge.

THE ACUTE ARTHRITIS OF INFANTS.

In 1874 Sir Thomas Smith described, under the title of Acute Arthritis of Infants, a series of cases in which young children were attacked with an acute form of arthritis, attended with early supuration and disorganisation of the joints, and often terminating fatally. All the patients were under a year old, and in several the affection was developed in the first week or two of life. In some instances as many as four of the large joints were involved. In one infant swelling of the right knee was noticed very soon after birth, and in the next month the opposite knee, the left elbow, and the left ankle were attacked. One patient, a female infant four weeks old, along with purulent polyarthritis, had empyema. In these cases on post-mortem examination it was almost invariably found that the arthritis was secondary to an abscess which had developed in the end of one of the bones forming a joint, and had made its way through a pinhole orifice in the cartilage into the joint. When his paper was written Sir Thomas Smith was not in a

position fully to explain the pathology of these abscesses, although the post-mortem examination indicated in some of the instances that the cases were associated with pyæmia. But none would, I think, at present hesitate to believe that they were infective in their origin.

UNCLASSIFIED CASES.

The following cases have been seen in the last few years, either in consultation or in hospital practice :

CASE I.—A man, aged fifty-four, who had been a free liver, and had diabetes, had a large boil on the abdomen near the groin. This was opened, and two drachms of offensive pus were let out. Within two or three days he had very acute inflammation of the right knee-joint, which became flexed, considerably swollen, and globular from periarticular infiltration (there was no fluid in the joint), and intensely painful. The skin was red and shiny, suggesting early suppuration. But none occurred. The patient had a high temperature, and was very ill. On seeing him with Mr. John Adams, of Aldersgate Street, I suggested boric fomentations and weight extension. Under treatment, very carefully carried out by Mr. Adams's partner, Dr. Dyson, slow improvement occurred,

and in six months the patient was able to be up on crutches; fibrous ankylosis, however, occurred. The patient is now well, and the joint is free from pain. The knee is slightly flexed and quite stiff. Infection was, I believe, due to absorption from the abscess in the abdominal wall.

CASE II.—A case almost exactly similar, except that the source of infection was obscure, was that of a lady, aged thirty-seven, a patient of Dr. Haynes, of South Kensington. This lady 'caught a severe chill' at an evening entertainment in cold weather. Next day she had severe pain in the right knee, which became red on the surface and considerably swollen. Pain was so severe and prolonged that it was necessary to keep the joint on a splint for two months. For several weeks the temperature was raised. Pain and swelling slowly subsided, but the joint was left firmly ankylosed. At the present time there is no pain, but the knee is quite stiff and still enlarged by brawny periarticular thickening.

CASE III.—An unmarried lady of twenty-three had acute arthritis of the right knee, following a wrench at tennis. The joint, a week after the injury, was considerably swollen, very painful, and covered with dusky red skin. The joint contained

no fluid, but the periarticular tissues were thickened and brawny. The limb was kept at rest on a back splint and swung from a cradle. The patient's temperature was 99° in the morning and 101° in the evening, and for the next month pain continued to be severe, and it seemed probable that suppuration would occur. From this time, however, very slow improvement took place, and at the end of three months the splint was removed. The limb was in good position, but the joint had undergone close fibrous ankylosis, and the patella was firmly fixed on the condyles of the femur. The patient six months later was walking freely on the limb, but the joint was so completely rigid that I believe the ankylosis, which was at first fibrous, had now become bony.

CASE IV.—Mr. X., aged twenty-four, had an illness extending over about six weeks and attended with rise of temperature. Several of the large joints and the finger-joints were the seat of pain and swelling, but the left ankle was especially involved: it was extremely painful and considerably swollen. All the other joints recovered, but the ankle remained inflamed and painful for two months, and ultimately became firmly ankylosed. I saw Mr. X., in consultation with Sir A. Garrod, and we agreed in regarding the condition as gono-

coccal in its origin. But this the patient firmly denied. As the foot was in a condition of slight talipes equinus I manipulated it under ether and brought it up within a right angle with the leg. During this proceeding, which required some force, strong cicatricial tissue was torn through. The ankle-joint itself remained stiff, but by long-continued manipulation and exercises considerable movement was acquired in the medio-tarsal joint, so that the patient ultimately walked with only slight lameness. It is, of course, impossible to be sure that gonococcal infection did not occur in this instance, but as the patient, who was intelligent and straightforward, persistently denied it, it seems unreasonable to assume its presence; and looking at the case in the light of recent experience I now regard it as one of some other infection, although here, as in preceding cases, what the agent was, whether either the pneumococcus or the streptococcus, I cannot say.

CASE V.—A man, aged twenty-nine years, was admitted into St. Bartholomew's Hospital, in whom all the large joints of the lower extremities had undergone ankylosis after an illness attended with fever of thirteen weeks' duration. As to the nature of this illness no trustworthy information could be obtained, but apparently there had been no

gonococcal infection. I think there need be no hesitation in pronouncing this case one of infection. But whether the infective agent was the pneumococcus or the streptococcus or some other must remain uncertain.

CASE VI.—A lady, aged thirty-five, was suddenly attacked with swelling and severe pain in the left ankle, which became uniformly and considerably swollen. Pain in the next three days increased to great severity. The temperature was 101° – 102° , and the skin was red and shiny as if suppuration would occur. The joint was carefully supported in a poro-plastic splint and covered with warm boric fomentation. As the patient had had gout on a previous occasion this attack was at first considered to be of this nature, and colchicum was prescribed. No improvement followed, and salicylate of soda also failed to give relief. Morphia was used hypodermically for seven or eight days to relieve the severity of the pain. The symptoms slowly subsided. Three months later the patient could walk on the foot, but the joint became firmly ankylosed. The source of the infection, which I cannot doubt was present, was quite obscure.

I have felt compelled, even at the cost of being wearisome, to state the clinical evidence which has

led me to believe that scattered about in everyday practice are a number of cases which have hitherto been regarded as 'rheumatic,' but which are really infective. Many such cases, it is true, when they are taken singly present no distinct resemblance to what are usually regarded as the typical forms of infective arthritis. When, however, they are massed together and their features are compared, and when they are studied in connection with observations which have recently been made in bacteriology, their real nature appears to admit of scarcely any reasonable doubt; and I venture to anticipate that in the future their comparatively common occurrence will be generally recognised.

PROGNOSIS AND TREATMENT.

In the first form of infective arthritis which I have mentioned—that, namely, which consists of a transient synovitis, attended with limited effusion—prognosis is favourable. The arthritis soon subsides, often in the course of four or five days, and the joints completely recover. A suitable splint and warm fomentations will be the only treatment required.

In the second group, in which the joint-cavities contain fluid, the treatment imperatively called for is clear. It is the same as that which should be

employed in gonococcal infection, where effusion has occurred. The fluid must at once be removed, and the joint freely irrigated, either with carbolic lotion (1-100) or with mercurial solution, of which perhaps the best form is biniodide (1-1000). To evacuate the fluid, a full-sized hydrocele trocar and cannula may be used, and irrigation can be readily performed through the cannula, or the joint may be opened by an incision at the side of the patella. If the fluid proves to be already purulent, the joint must be freely opened and the finger inserted to break down any adhesions which may have formed, and behind which pus might be imprisoned, and then thorough and copious irrigation must be carried out. The immediate improvement followed by complete recovery observed in Mr. Page's cases after evacuation and irrigation was very striking, and it has its parallel in what, I think, many surgeons will have observed in cases of pyæmia—namely, that when a joint has become distended with pus, if it is freely opened and copiously irrigated, it may forthwith undergo a startling improvement and, if the patient survives, may completely recover and retain absolutely free movement.

In the third or plastic form, prognosis is distinctly unfavourable. The arthritis tends, as I have said, to extend over a considerable period. A large amount of new fibrous tissue is developed

both between the articular surfaces and in the periarticular tissues, and the joint is converted into a massive scar, so that firm fibrous ankylosis, which may subsequently become bony, results. This strong tendency towards ankylosis is, I think, one of the special characteristics of infective arthritis. Nor are any means at present known by which ankylosis can be prevented.

As to treatment, the best that can be done is to keep the joint for the time being at complete rest—indeed, the pain is such that no alternative can be thought of. Warm boric or opiate fomentations are required during the most acute stage, but when swelling and heat have somewhat subsided, a succession of small blisters will alike relieve pain and promote absorption. Later still, massage will be required to remove the brawny œdema of the soft parts.

A very important question is whether, in any of these cases, manipulation should be employed with the object of restoring movement. In the slighter cases this is advisable, but when inflammation is either severe or prolonged—*a fortiori* if it is both—the joint becomes filled up with cicatricial tissue and the restoration of movement is impossible. Forcible manipulation in such conditions is not only useless but definitely mischievous, for it renews irritation and promotes the formation of scar

tissue. Moreover, I have seen instances in which manipulation has left a joint, which was previously free from pain, so sensitive and painful for many weeks that it was necessary to keep it at complete rest, so that, instead of being diminished, stiffness was increased.

In the fourth group prognosis is highly unfavourable, for the arthritis is but one of the manifestations of a general septicæmia, and is often associated with other lesions of the gravest kind. Often the arthritis is rendered comparatively unimportant—except for the suffering it entails—by the speedily fatal termination of the case. In those rare cases, however, in which the septicæmia is of a milder type and other local developments are absent, if the joint is at once freely opened and irrigated, repair may take place, sometimes with ankylosis, sometimes with the restoration of considerable—or even completely—free movement.

In the future, when our knowledge of pathology has become more exact, and when, as we may anticipate, each infective agent can be opposed by an appropriate anti-toxic serum, these cases, we may hope, will be treated with much more success than is at present possible.



